

Open Fractures

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PNU- 2016

Topics to Cover

- Definition
- Gustillo classification
- Management
- Special type of open #
- Complications

Introduction

Definition

- A # with a wound communicating it with the environment
- It could also be an open joint
- This is a Red Flag, an extreme Ortho emergency



Open Fractures

- Could be part of a poly trauma, still 1st → **ATLS**
- 1st deal with life threatening prior to limb threatening
- Need to be in O.R < 6h from time of injury
- Time is crucial:
 - Number of bacteria multiply exponentially by time
 - Bacterial colonization will lead to infection

Open Fractures

- If infection with a #:
 - Eradication → difficult
 - Antibiotics → long time
 - Multiple surgeries
 - Morbidity → significantly higher
 - Costs → definitely high






Classification *of Open Fractures*

Gustillo Classification

- It's a clinical classification, depending on:
 1. Size of the wound
 2. Amount of soft tissue involvement
 3. Degree of contamination
 4. Type of bone #
 5. Any periosteal stripping
 6. How sufficient is the skin to cover the wound
 7. Any N.V involvement

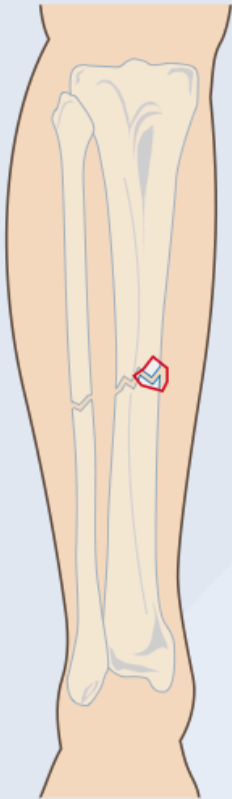


Gustilo Classification

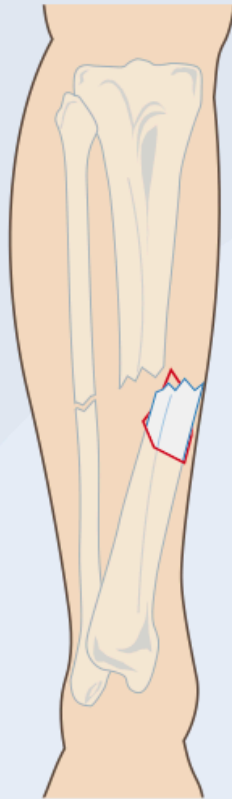
Gustilo Type	I	II	IIIA	IIIB	IIIC
Images					
Energy	Low energy	Moderate	High ≥10 cm	High	High
Wound Size	< 1 cm	> 1cm	Often large zone of injury	Often large zone of injury	Often large zone of injury
Soft Tissue	None	No extensive soft tissue damage	Extensive	Extensive	Extensive
Contamination	Clean	Moderate contamination	Extensive	Extensive	Extensive
Fracture Pattern	Simple fx pattern with minimal comminution	Moderate comminution	Severe comminution or segmental fractures	Severe comminution or segmental fractures	Severe comminution or segmental fractures
Periosteal Stripping	No	No	Yes	Yes	Yes
Skin Coverage	Local coverage	Local coverage	Local coverage	Requires replacement of exposed bone with a free flap for coverage	Local coverage
Neurovascular Injury	Normal	Normal	Normal	Normal	Exposed fracture with arterial damage that requires repair

Gustillo Classification

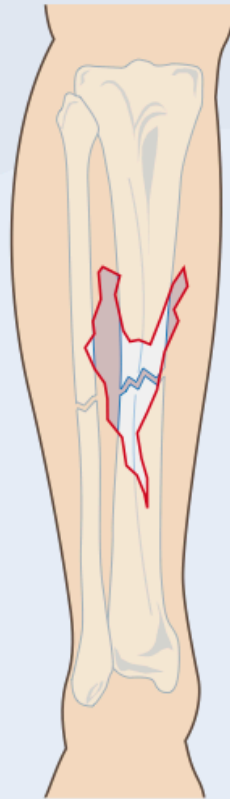
Gustilo classificatie



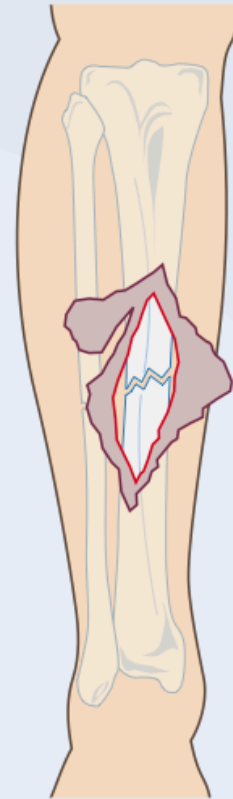
Gustillo 1



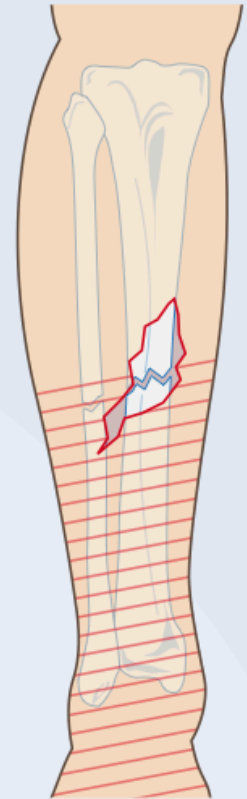
Gustillo 2



Gustillo 3A



Gustillo 3B



Gustillo 3C

Gustillo Classification

- Initial classification could change after O.R
- % of wound infection correlates directly with the extent of soft tissue damage:
 - Type-I \rightarrow $< 2\%$
 - Type-III \rightarrow $> 10\%$
- ALL open #'s MUST be assumed CONTAMINATED

Gustillo Classification

- Type I:
 - Wound → puncture & < 1 cm
 - Soft tissue → little damage
 - # → simple



Gustillo Classification

- Type II:
 - Wound → 1 -10 cm, no skin flap
 - Soft tissue → more damage
 - # → simple or comminuted



Gustillo Classification

- Type III:
 - Wound → > 10 cm, extensive skin laceration
 - Soft tissue → extensive damage
 - # → comminuted
 - Grades:
 - III-A → bone can be adequately covered
 - III-B → extensive periosteal stripping, bone can't be covered
 - III-C → if there is vascular injury needing surgery



Management

Management Outline

- ER:
 - ATLS (time of accident & mechanism)
 - Local O/E & N.V assessment
 - Take photos
 - R/O big & visible foreign bodies
 - Align if needed & recheck N.V
 - Saline-soaked sterile dressing
 - Splint the #
 - ABx prophylaxis
 - Tetanus injection
- O.R:
 - Take immediately
 - For irrigation & debridement
 - Proceed to immobilization...
 - Beware of compartment syndrome

Management in E.R

ER Management

- ATLS:
 - Life threatening prior to limb threatening
 - Time of accident (the 6 golden hours)
 - Mechanism of injury (associated injuries)
- Local O/E & N.V assessment
- Take photos
- R/O big & visible foreign bodies
- Align if needed & recheck N.V
- Saline-soaked sterile dressing → R/O only in OR
- Splint the # → till reach O.R

Antibiotics

- Initially we give 3-ABx:
 - Cefuroxime → G+
 - Gentamycin → G-
 - Metronidazole → anaerobe
- Duration of ABx depends on the clinical situation

Tetanus

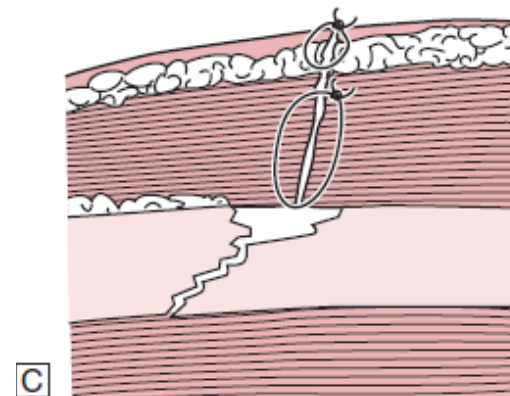
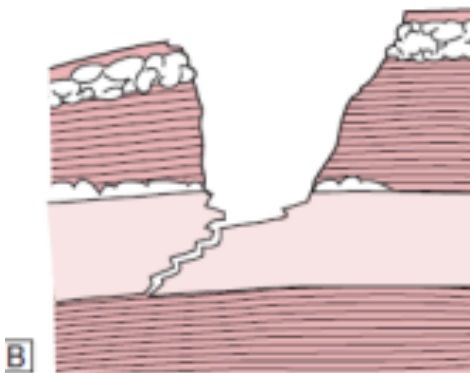
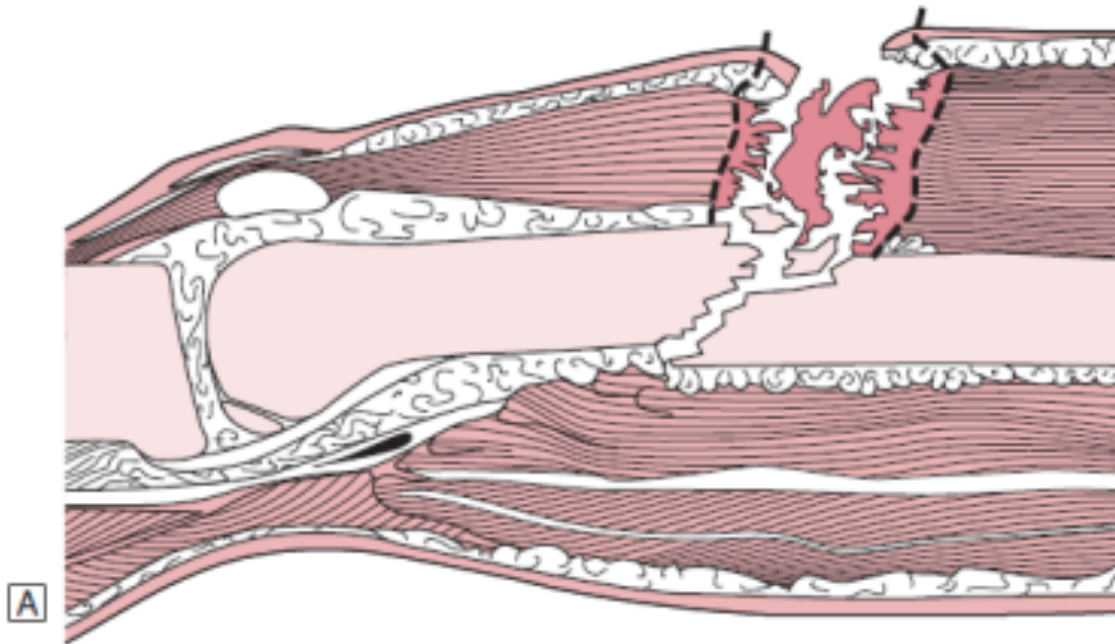
- Immunized:
 - $< 10y \rightarrow$ tetanus toxoid (TT) booster
 - $> 10y \rightarrow$ TT + Human tetanus immunoglobulin
- Unimmunized / Unknown
 - Human tetanus immunoglobulin

Management in O.R

O.R Management

- Irrigation:
 - Copious amount of warm N.S (6-12L), or even more
- Debridement:
 - Sharp dissection of devitalized tissues (color, consistency, contractility, circulation)
 - With anatomical layers, skin to bone
 - Wound extensions → thorough cleaning necessitates adequate exposure
 - R/O any **free** bone fragments & foreign bodies
- Re-irrigation

O.R Management- Debridement



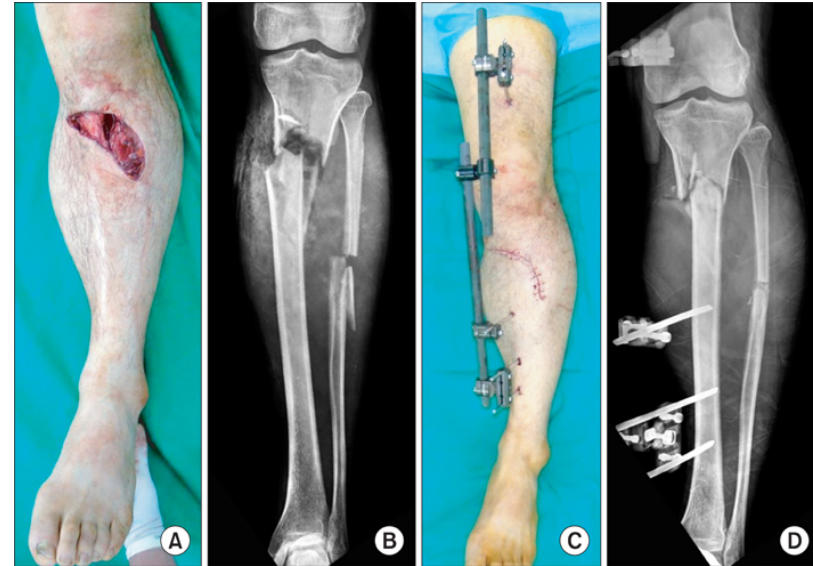
O.R Management

- Fracture stabilization:
 - Type-I → definitive fixation, as if closed #
 - Type-III → external fixation (ext.fix)



O.R Management

- Fracture stabilization:
 - Type-II:
 - I.M.N
 - Ext. Fix
 - **Never** plating
- External fixation could be:
 - A temporary option
 - Or a definitive treatment



O.R Management

- If type-III C:
 - Ortho → stabilize the # 1st
 - Vascular team → join to repair the vascular injury
- If type-III B:
 - Ortho → stabilize the # 1st
 - Plastic team → join for skin cover, primary or secondary
- If anticipating compartment syndrome → do prophylactic fasciotomy

O.R Management

- The wound usually can be closed primarily → in type: I, II, & III-A.
- The wound is kept open if:
 - Sever swelling
 - Can't achieve a clean wound after debridement
 - Inexperienced surgeon
- If wound is kept open → 2nd look surgery at 48h
- There might be a need for repeated re-look Q48h

Post Operative Treatment

- Still, beware of compartment syndrome
- If the wound got infected:
 - Take swab for C/S
 - Might need I/D again (if infection became deep)
 - Might be hospital acquired if the wound was kept open for several days

Special Type of Open #

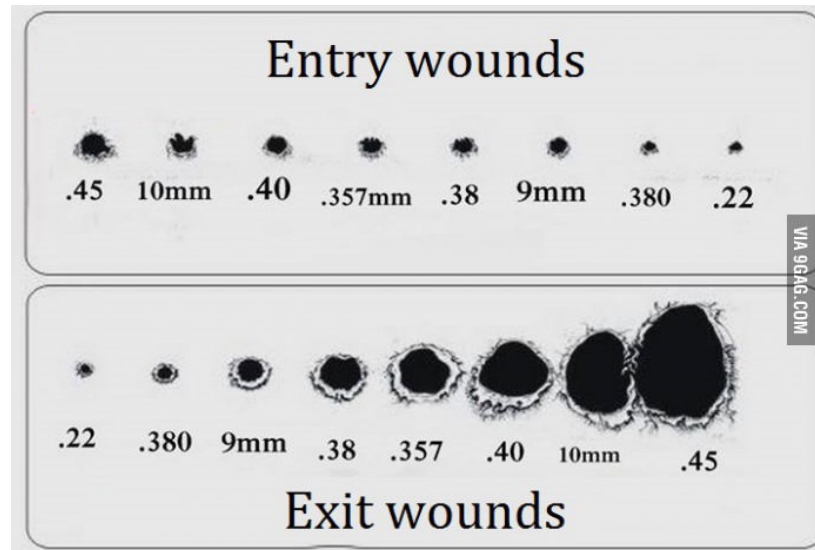
Gun Shot

- Tissue damage is due:
 - Mechanical:
 - Direct injury from the tract
 - Contusions & congestion of the muscles & soft tissues at a greater distance from the primary tract (blast effect)
 - Thermal injury



Gun Shot

- Entry wound is much smaller than the exit wound, if any
- Must know the type of gun, the bigger the bullet the greater the damage



Gun Shot

- All gun shot injuries debris are sucked into the wound, contaminating it
- Same treatment principles:
 - Both entry & exit wounds to be covered
 - Higher incidence of N.V injury

Gun Shot

- If low velocity weapons:
 - With clean entry → treat as type-1
 - If only soft tissue injury → treat as wound care & Abx
- If high velocity:
 - Treat as type-III
 - Causes bone splintering
 - Due to the blast effect → the requirement for fasciotomy is higher

Complications

Complications

- Skin:
 - Multiple scars
 - If skin graft or flap is used → different skin colors
 - Wound contracture, specially around joints
 - Graft/flap failure
- Bone:
 - O.M (or septic arthritis):
 - Acute or chronic
 - Staph > MRSA > pseudomonas
 - If a fragment was lost in the field or comminuted → L.L.D
- Prolonged hospital stay
- Psychological

Any Question ?

Remember

Take Home Message

- Still ATLS takes priority
- The golden 6h post trauma
- Importance of taking a photo
- Open # does not mean no compartment syndrome
- Essentials of Rx:
 - ABx & tetanus prophylaxis
 - Urgent wound debridement
 - Stabilization of #
 - Early definite wound cover
- Classification helps in management
- Treatment of different types of gun shot injuries
- All of this to avoid complications

Lecture Objectives

- What is open #
- Gustillo classification
- Principles of management in E.R & O.R
- ABx & tetanus prophylaxis
- Principles of (wound & #) debridement
- Types of # stabilization
- Treatment of different types of gun shot injuries
- Complications